Space Weather Technical Forecast

Issued on Monday 11 November 2024 at 00:42 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Moderate solar activity is likely, with a slight chance of X-class flares. Chance of G1 13 Nov.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate during the period, with three impulsive M-class flares all from AR3889 in the southeast, the largest being an M9.4 flare at 10/1206 UTC. There are seven sunspot regions on the visible disc. AR3889 in the southeast, is the largest and most complex region. It contains a number of mature spots and now has two delta regions, one in the trailing and another, perhaps more significant region, in the leading portion. This spot has seen continued growth in penumbra especially around its leading portion, which seems to be the most active part. AR3883, in the southwest, has mature leading and trailing spots, but has seen some decay in the spots occupying the intermediate region. AR3879 in the northwest is large and mature, though appears stable. The remaining spot regions are smaller and magnetically simple.

No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds at L1 measured by ACE and DSCOVR were indicative of ongoing magnetic cloud with CH HSS influences. Wind speeds were slightly elevated and at around 360-450 km/s. Density was mostly average, but peaked above average, around 21 ppcc measured at 10/1154 UTC. The Interplanetary Magnetic Field (IMF), Bt, was Moderate on a slow-declining trend, initially around 12nT and finishing around 8nT. The north-south component, Bz, was mostly southward (negative) directed at Weak to Moderate levels with a minimum around -11nT, but rotated to weakly positive towards the end of the period. Phi angle was initially neutral but became positive from 10/1200UTC. A noticeable kick in the UK Magnetometers was observed around 10/1830 UTC, with Hartland showing a deflection of 118nT. This is believed to be in association with a HSS from CH88/+, but there was no evidence of increased geomagnetic activity at L1 prior to this event.

Resultant Geomagnetic Activity was generally quiet to Active (Kp 2-4), with a G1 Minor Storm (Kp 5) interval at 10/0300-0600UTC and a G2 Moderate storm (Kp6) interval at 10/1800-2100.

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels throughout. The associated 24-hour fluence was well below the Active threshold, with 1.54e6 integrated flux observed at 11/0000UTC.

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Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is forecast to continue, with a likelihood of isolated M-class flares and a slight chance of X-class flares, these probably from AR3889.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently forecast. HSS influences are expected through this period, initially from CH88/+ in the southwest and later from the large CH90/+ currently crossing centre disc. Current slightly elevated winds are expected to decline to background through Day 1 (11 Nov), before becoming elevated again towards the end of the period.

Generally Quiet to Unsettled (Kp2-3) activity is forecast but with Active (Kp4) intervals likely and a chance of peak G1/Minor Storm conditions, most likely Days 1 and 4 (11 and 14 Nov) due to the risk of HSS influence. Unsettled to Active (Kp3-4) condition increasingly likely to end the period, with a chance of G1/Minor Storm conditions upon the connection to CH90/+.

Energetic Particles / Solar Radiation: High energy proton flux at GOES-18 is at normal background levels. There is a rising slight chance of S1/Minor Proton Storms should we see any significant flares, as the larger regions on the disk rotate into more geoeffective positions in the western hemisphere. The high energy electron flux is expected to remain at generally Background to Moderate levels. The associated fluence is excepted to persist below Active levels.

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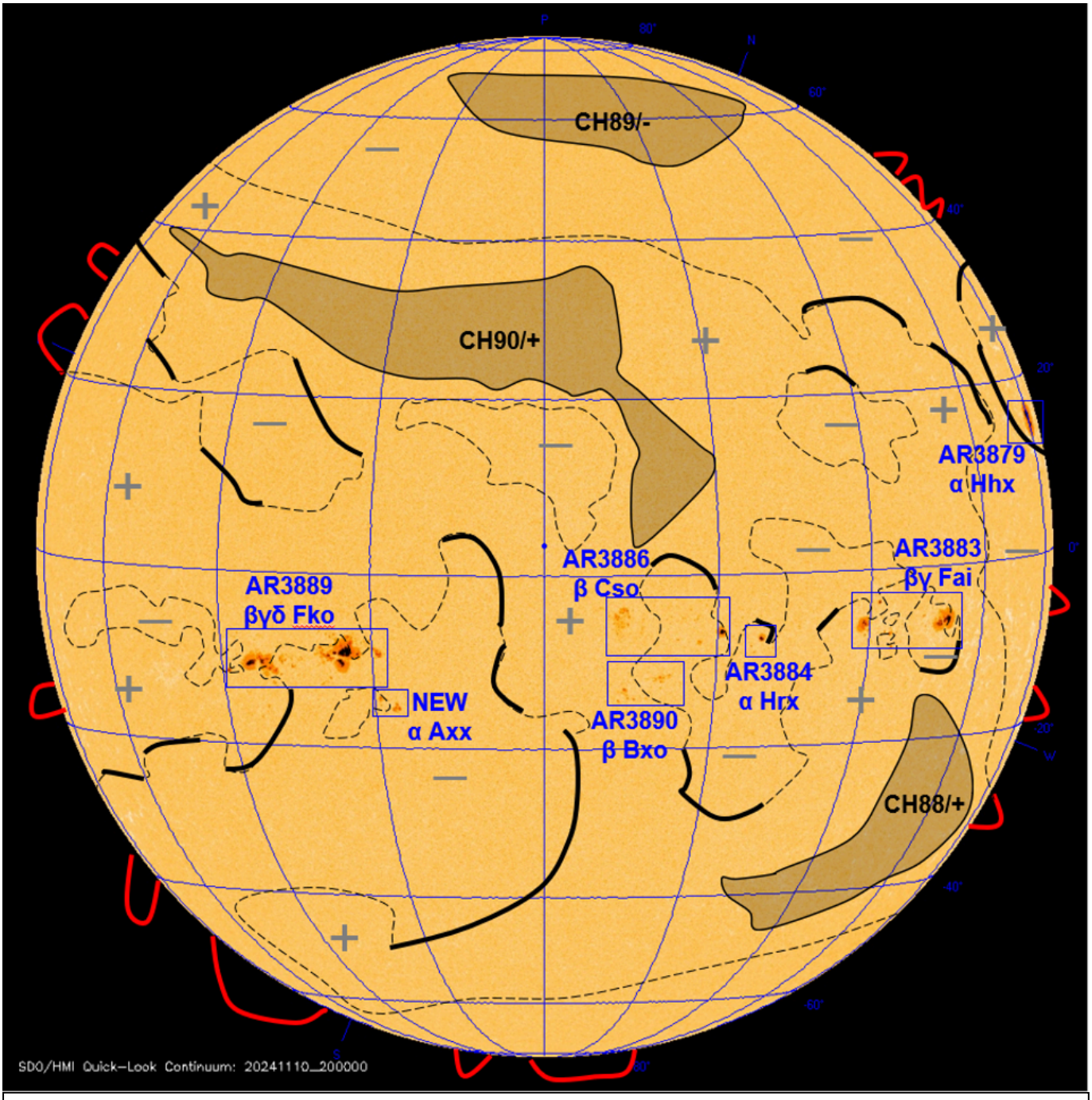
Figure 1: Solar synoptic map valid 10/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

No Earth-directed CMEs are currently forecast, however, some weak transients from faint dimmings near centre disk on 08 Nov may arrive during the period.

Solar winds are currently experiencing ongoing CME or coronal hole high speed stream influences, potentially from CH88/+ in the southwest. Slightly Elevated solar wind speeds are considered most likely on Day 1 (11 Nov), around 400-450 km/s slowly easing later Day 1 (11 Nov) or early Day 2 (12 Nov). Solar wind speeds expected to trend back towards background levels through Day 2 (12 Nov) in the absence of further enhancement. An increase in solar winds to 450-500 km/s then likely later Day 3 or into Day 4 (13-14 Nov) with an expected connection to some portion of the large coronal hole CH90/+ currently crossing centre-disk. This likely bringing Slightly Elevated to Elevated solar wind speeds to end the period. MOSWOC ENLIL is providing reasonable guidance, however it is believed to be underdoing the speeds expected later in the period associated with CH90/+

Generally Quiet to Unsettled (Kp2-3) activity is forecast but with Active (Kp4) intervals likely and a chance of peak G1/Minor Storm conditions, most likely Days 1 and 4 (11 and 14 Nov) due to the risk of HSS influence. Unsettled to Active (Kp3-4) condition increasingly likely to end the period, with a chance of G1/Minor Storm conditions upon the connection to CH90/+.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	30	10	20	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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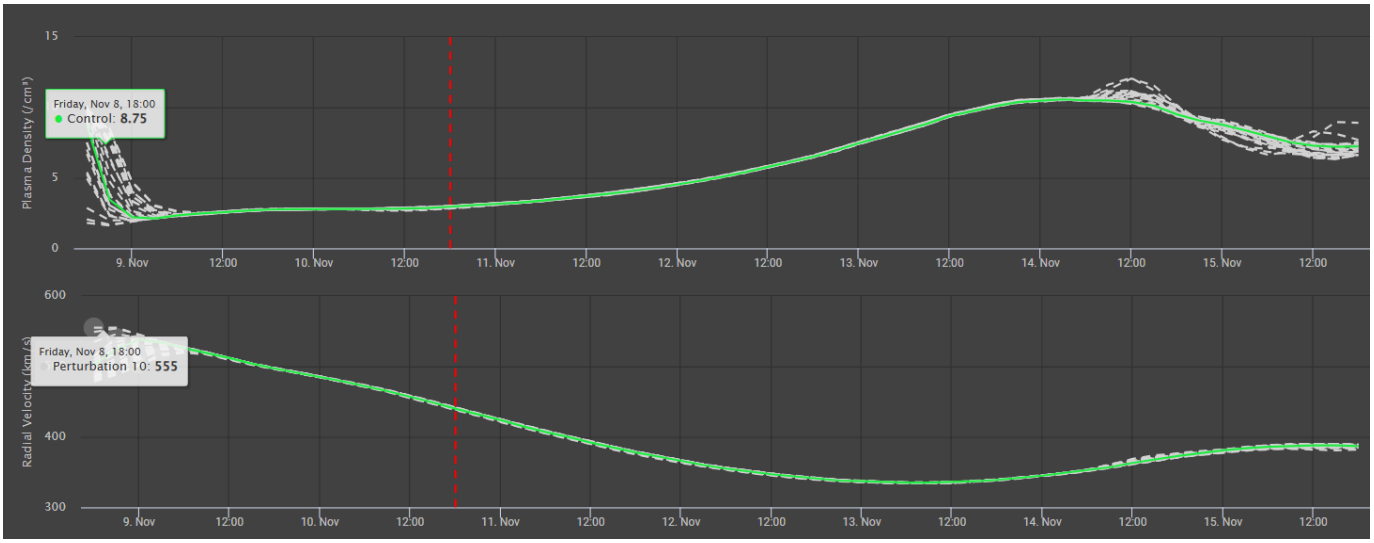
Figure 2: MOSWOC ENLIL ensembles showing HSS influences



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Radio Blackouts - X-Ray Flares

Solar activity was Moderate during the period, with three impulsive M-class flares all from AR3889 in the southeast, the largest being an M9.4 flare at 10/1206 UTC. Moderate activity is forecast to continue, with a likelihood of isolated M-class flares and a slight chance of X-class flares, these probably from AR3889.

There are seven sunspot regions on the visible disc. AR3889 in the southeast, is the largest and most complex region. It contains a number of mature spots and now has two delta regions, one in the trailing and another, perhaps more significant region, in the leading portion. This spot has seen continued growth in penumbra especially around its leading portion, which seems to be the most active part. AR3883, in the southwest, has mature leading and trailing spots, but has seen some decay in the spots occupying the intermediate region. AR3879 in the northwest is large and mature, though appears stable. The remaining spot regions are smaller and magnetically simple.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	70	70	70	70
Very Active	R3-R5 (X Class)	No	20	20	20	20

Figure 3: 24 hour X-ray GOES 16/18 trace

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Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES-18 is at normal background levels. There is a rising slight chance of S1/Minor Proton Storms or greater however should we see any significant flares, with the larger regions on the disk rotating into more geoeffective positions in the western hemisphere through the period.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	15	20
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 is at Background levels.

The high energy electron flux is expected to remain at generally Background to Moderate levels, potentially increasing to brief High levels at diurnal peak early in the period. The associated 24 hour fluence is expected to remain below Active levels aligning with the MOSWOC REFM output, which appears to provide reliable guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	1
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

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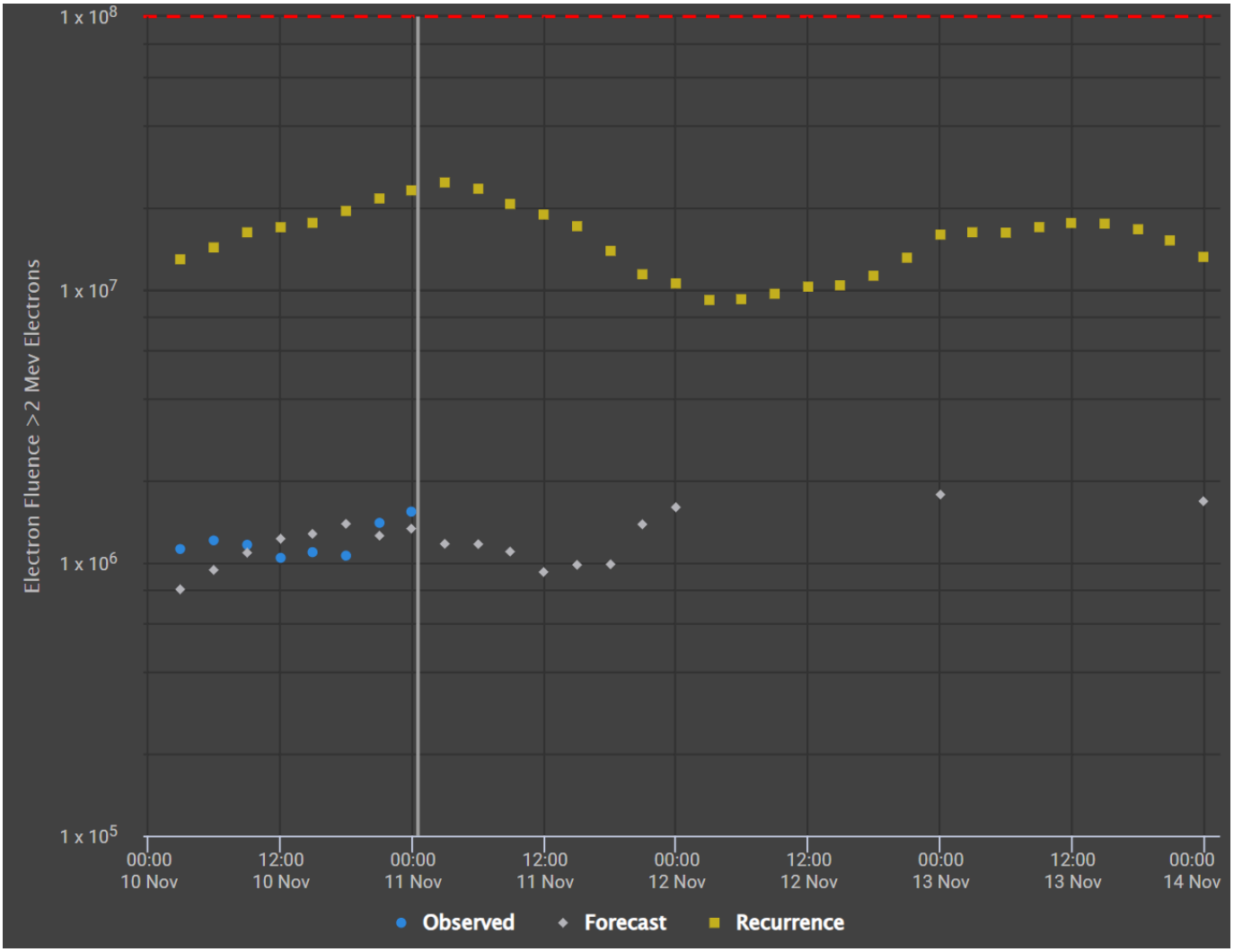
Figure 4: MOSWOC REFM fluence forecast/observations/recurrence



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